



# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference AMS.P52287WO		<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/PEA/416)	
International application No. PCT/GB 03/04190	International filing date (day/month/year) 24.09.2003	Priority date (day/month/year) 27.09.2002	
International Patent Classification (IPC) or both national classification and IPC G01V1/36			
Applicant WESTERNGECO SEISMIC HOLDINGS LIMITED et al.			
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 5 sheets, including this cover sheet.</p> <p><input type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of sheets.</p>			
<p>3. This report contains indications relating to the following items:</p> <p>I <input checked="" type="checkbox"/> Basis of the opinion</p> <p>II <input type="checkbox"/> Priority</p> <p>III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p>IV <input type="checkbox"/> Lack of unity of invention</p> <p>V <input checked="" type="checkbox"/> Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p>VI <input type="checkbox"/> Certain documents cited</p> <p>VII <input type="checkbox"/> Certain defects in the international application</p> <p>VIII <input type="checkbox"/> Certain observations on the international application</p>			
Date of submission of the demand  04.03.2004		Date of completion of this report  21.05.2004	
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465		Authorized Officer  Schneiderbauer, K  Telephone No. +49 89 2399-7613 	



# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB 03/04190

## I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

### Description, Pages

1-17 as originally filed

### Claims, Numbers

1-21 as originally filed

### Drawings, Sheets

1/4-4/4 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:



**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/GB 03/04190

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**1. Statement**

Novelty (N)	Yes: Claims	1-21
	No: Claims	
Inventive step (IS)	Yes: Claims	1-21
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-21
	No: Claims	

**2. Citations and explanations**

**see separate sheet**



**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB03/04190

The examination is being carried out on the following application documents:

**Description, pages:**

1-17 as originally filed

**Claims, No.:**

1-21 as originally filed

**Drawings, sheets:**

1/4-4/4 as originally filed

**1.) Reference is made to the following documents:**

- D1: US 2002/118602 A1 (STOFFA PAUL L ET AL) 2002-08-29  
D2: US-A-5 774 416 (SADEK SELWA ET AL) 1998-06-30  
D3: SCHALKWIJK K M ET AL: 'APPLICATION OF TWO-STEP DECOMPOSITION  
TO MULTICOMPONENT OCEAN-BOTTOM DATA: THEORY AND CASE STUDY'  
JOURNAL OF SEISMIC EXPLORATION, vol. 8, no. 8, 1999

**2.)** The application does not comply with **Art.6 PCT** because the subject-matters of claim 1 (method) and claim 14 (apparatus) are too broadly defined. It is not clear to the skilled person how to create a calibration filter employing processing steps in the common shot domain. The creation of the calibration filter comprising steps in the common shot domain has to be carried out in a particular way as described in the embodiments of the invention with respect to figures 2 and 3 (s. also PCT-Guidelines, section IV/ III-6.5).

In the further examination, claims 1 and 14 have been interpreted in the light of these embodiments with respect to figures 2 and 3.

**3.) Technical field:** seismic data processing

**4.) Novelty (Art.33(1),(2) PCT) and inventive step (Art.33(1),(3) PCT):**

Document D3 is considered to be the closest state of the art. D3 discloses a solution for the calibration problem between two different component measurements (hydrophone and geophone). The hydrophone is assumed to be well coupled to the seismic



**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB03/04190

wavefield and the particle velocity (which has been measured by the geophone) is calibrated against the pressure (hydrophone) to compensate for coupling differences between the two sensors. A frequency dependent calibration filter is derived in the common - receiver domain using a time window that inadvertently can include direct or multiple events. This leads to incorrect results for the calibration filter.

The present invention differs from D3 in that the processing steps which lead to the calibration filter are done in the common shot domain according to the embodiments described with reference to figures 2 and 3. This allows the calibration filters to be determined from the up- and downgoing components of the particle velocity.

Processing is simplified and better results are achieved for the filter.

D1 and D2 from the ISR are not considered to be relevant for the present invention because they do not hint at a method for finding such a calibration factor which comprises data processing steps in the common shot domain.

D1 describes a method for attenuating free surface multiples taking into consideration the angle dependance of the up- and downgoing wavefields. Seismic data are recorded in the offset distance-time domain in which hydrophones and geophones are calibrated with respect to each other. D2 describes a method for attenuating water column reverberations in seismic data. To this purpose the seismic signal is decomposed into bandwidth limited signals which are normalized. The normalization factors can be organized by "common shot" where all normalization factors are computed from signals which have been generated by the same source. The normalized data are used in a further processing step for the elimination of reverberations.

As none of the documents of the ISR disclose or hint at a method (apparatus) as claimed in independent claims 1 and 14, the subject-matters of these claims are new and inventive.

**5.) The dependent claims:**

Claims 2-13, 20 and 21 are dependent on claim 1 and claims 15-19 are dependent on claim 14 and do as such also meet the requirements of the PCT with respect to novelty and inventive step.

**6.) Industrial applicability (Art.33(1),(4) PCT):**

Beyond any doubt the invention, as defined in claims 1-21, is industrially applicable.